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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/920,978	08/01/2001	Shane J. Trapp	M122-1674	6594

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SPOKANE, WA 99201-3828

EXAMINER

BLUM, DAVID S

ART UNIT	PAPER NUMBER
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2813

#3

DATE MAILED: 03/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/920,978

Applicant(s)

TRAPP, SHANE J.

Examiner

David S Blum

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-43 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>2</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-5, 8-14, 16-17, 19-26, 29-35, 37-39, and 41-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolf in view of Ding (US 5,814,563).

Wolf teaches all of the positive steps of claims 1-5, 8-14, 16-17, 19-26, 29-35, 37-39, and 41-43 except for the use of ammonia as the source of hydrogen and various and multiple fluorocarbons, hydrocarbons, chlorofluorocarbons and chlorohydrocarbons.

Wolf (page 40 volume 2 teaches etching a trench in a semiconductor by etching through a patterned mask of pad oxide, nitride layer and photoresist, and into the silicon substrate. Wolf also teaches (pages 555-557 volume 1) anisotropic plasma etching through the mask and into the substrate using a dry etch of CF₄ gas and that the shape of the trench (result of etch selectivity) can be altered by adjusting the fluorine-to-carbon ratio with hydrogen additions and altering the etch chemistry to make the etchant more selective toward the photoresist. Wolf teaches the chlorofluorine gas for etching nitride, silicon oxide, and silicon.

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Ding teaches etching silicon oxide using fluorohydrocarbon gasses in an etching chemistry containing ammonia (NH₃, a source of hydrogen, abstract) and in a magnetic field (magnetically enhanced plasma etching column 5 lines 13-15), the volumetric ratio of fluorohydrocarbon to ammonia is 2.5: to 7:1 Column 2 line 57). Ding also teaches using a combination of two fluorocarbons (column 9 line 65-column 10 line 4).

One skilled in the requisite art at the time of the invention would modify Wolf by including multiple fluorocarbons in conjunction with ammonia as a hydrogen source with reasonable expectation of producing a trench with better control of the etch profile angle (Ding column 1 line 55, Wolf page 552).

3. Claims 15 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolf in view of Ding (US 5,814,563) as applied to claims 1 and 22 and 33 above, and further in view of Sugishima (US 4,352,724).

Wolf and Ding teach all of the positive steps of claims 15 and 36 as recited above except that the etchant may contain at least 3 fluorocarbons. Sugishima teaches the use of fluorocarbons to etch silicon, silicon oxide, and silicon nitride, (Table I) and suggests that a mixed gas of at least two of the listed chloride gasses (C₂F₅Cl and C₂F₅Cl+CF₄ are listed) and mixed with CF₄ and CF₆.

One skilled in the requisite art at the time of the invention would modify the etchant of Ding containing two fluorocarbons to including 3 fluorocarbons as taught by Sugishima

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with reasonable expectation of producing a trench with controlled profile (Sugishima column 1 lines 50-52, Ding column 1 line 55, Wolf page 552).

4. Claims 6-7, 18, 27-28 add 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolf in view of Ding (US 5,814,563).

Wolf and Ding teach all of the positive steps of claims 6-7, 18, 27-28 add 40 as recited above except for having an etch chemistry where the ratio of fluorocarbon to ammonia is no less than 9:1 or at least 20:1.

Wolf teaches that the shape (profile) of the trench (result of etch selectivity) can be altered by adjusting the fluorine-to-carbon ratio with hydrogen additions and altering the etch chemistry to make the etchant more selective toward the photoresist.

Ding teaches etching silicon oxide using fluorohydrocarbon gasses in an etching chemistry containing ammonia (NH₃, a source of hydrogen, abstract) the volumetric ratio of fluorohydrocarbon to ammonia is 2.5: to 7:1 Column 2 line 57).

These ranges are considered to involve routine optimization while it has been held to be within the level of ordinary skill in the art. As noted in re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances,

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however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art. Such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

One skilled in the requisite art at the time of the invention would have used any ranges or exact figures suitable to the method in the process of etching regarding chemistry ratios and concentrations using prior knowledge, experimentation, and observation with the apparatus used in order to optimize the process and produce the trench structure desired to the parameters desired.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

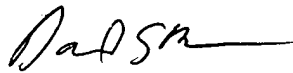
US 6,140,168	Tan	etching silicon oxide with fluorocarbons
US 5,286,344	Blalock	etching silicon oxide with fluorocarbons
US 4,836,887	Daubenspeck	etching chemistry tables
JP 9-129608		etches silicon nitride and silicon oxide with fluorocarbons

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (703)-306-9168 and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached at (703)-306-2794. Our facsimile number is (703)- 305-0142 and our receptionist's number is (703)-308-0956.



David S. Blum

February 15, 2002